Multiplicities and spectra of prompt fission neutrons up to 200 MeV

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The energy distributions of prompt fission neutrons for E_n up to 200 MeV are of great importance for the accelerator-driven system technologies of sustainable energy production and radioactive waste transmutation. Model calculations were performed to interpret the prompt fission neutron spectra (PFNS) of ^{232}Th(n,f) and ^{238}U(n,f) reaction for $E_n \lesssim$20 MeV recently [1]. Pre-fission ^{238}U(n,xnf) reaction neutron spectra were calculated with a Hauser-Feshbach statistical model, ^{238}U fission and (n,xn) reaction cross section data being fitted. The average energy of the pre-fission (n,nf) neutrons is shown to be rather dependent on E_n. For E_n= 6 - 9 MeV the lowering of PFNS average energy, which is due to the pre-fission (n,nf) neutrons, is reproduced. For E_n= 13 - 18 MeV a lowering of the measured PFNS average neutron energies was interpreted. Spectra of neutrons, evaporated from fission fragments, were approximated as a sum of two Watt' distributions. Recently energy distributions of prompt fission neutrons for incident neutron energies up to 200 MeV were reported [2], multiplicity data for ^{235}U(n,f) and ^{238}U(n,f) might appear soon [3]. We would extend our phenomenological approach up to 200 MeV. A self-consistent model on the basis of the energy balance with the incorporation of chance structure of fission would be employed [4]. It was verified below 20 MeV. The calculated values are compatible also with experimental data for $E_n \sim$ 20-50 MeV for the ^{232}Th, ^{235}U, ^{238}U target nuclides. We will explore the energy dependence of the pre- and post-fission neutron multiplicities. Realistic calculations of average energies of pre-fission neutrons would be carried out for E_n up to 200 MeV for the consistent neutron multiplicity analysis at high incident energies for (n,f) and (p,f) reactions. Importance of separate measurements for the ν_{pre} and ν_{post} for (n,f) and (p,f) reactions would be exemplified.

References

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